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E73-11148) APPLICATION OF EREP IMAGERY
TO FRACTURE-RELATED MINE SAFETY HAZARDS
AND ENVIRONMENTAL PROBLEMS IN MINING
Quarterly Progress (Indiana Geological
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Quarterly Progress Report July 20-October 20, 1973
EREI Investigation No. 325, Contract NAS-9-13358

October 22, 1973

TITLE: Application of EREP Imagery to Fracture-Related Mine Safety
Hazards and Environmental Problems in Mining

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OVERALL STATUS:

A. Imagery

SKYLAB 2 made a successful, essentially cloud-free pass over the test area on June 10, 1973. The following image products from that overpass have been received.

- S-192 multispectral (bands 2, 7, 11) films to be used for selection of detailed site for MSS play-out in 24 channels
- S-190 A multispectral black and white film in four bands (500-600nm, 600-700nm, 700-800nm, 800-900nm) in 70mm format.
- S-190 B natural color, (S0-242) metric camera film in 5 inch format.

B. Ground Truth

- a. Ground truth measurements were made by the Principal Investigator during the SKYLAB 2 overpass on June 10, 1973.
- b. A field trip was conducted in the Indiana Test Area from August 13-16, 1973. The following tasks were accomplished:
 - Underground coal mine investigation
(Kings Station Mine)

- Underground and surface coal mine visits and interviews with mine officials concerning roof stability problems.
- Discussions with state and mine company personnel regarding the use of ERTS/SKYLAB and design of user products.
- Field checking of fracture lineaments on the ground.
- Field measurements of fractures at outcrops and mine highwalls
- Light aircraft flight to observe and acquire hand-held photography of fracture-lineaments, mine subsidence, and mine land reclamation, including sand and gravel operations.

C. Administration

Additional funds will be required to prepare the map products suggested in discussions with the State and mining companies.

It is desirable that practical products be prepared as the most user-acceptable demonstration of the value of SKYLAB data for State and Federal use.

RECOMMENDATIONS:

Because this program can benefit from the ERTS study (NAS 5-21795) in progress, additional funding for product development can result in major benefits to the SKYLAB Program. In particular, funds are needed to prepare unique mine safety, mine subsidence and mining - environmental (reclamation) products as tangible illustrations of unique SKYLAB data applications and in sufficient numbers for NASA distribution. Cost estimates are now in progress.

EXPECTED ACCOMPLISHMENTS:

- Additional geological fracture data to supplement ERTS-1 Mine Safety (roof fall and subsidence) Investigation will be gained.
- Additional environmental data on mined lands will be obtained. EarthSat's prototype National Mined Lands Inventory Map at 1:250,000 scale and other mined land inventory products can be updated using SKYLAB images.^{1/} Emphasis will be placed on the early reporting of significant results and uses of SKYLAB data.
- Areas mined for materials other than coal, (such as sand and gravel, limestone, and clay) will be studied.
- Areas of environmentally degrading features which result from mining activities (such as mine refuse dumps, slurry ponds, acid mine drainage, and mine subsidence) will be identified.

1/

Assumes funding assistance is provided (see reclamation data)

- Products derived from the data provided by all successive SKYLAB overpasses will be comparatively analyzed to determine the amount of new mining and reclamation progress between each overpass.
- All results and products will be made available to appropriate operating state/county agencies so that the utility and benefits of SKYLAB data can be evaluated.

SIGNIFICANT RESULTS:

A. Mine Safety/Hazards Analysis

Numerous fracture traces were detected on both the color transparencies and four 70mm black and white spectral bands. A large percentage of fields were in a fallow state at the time of SKYLAB overpass; this permitted the detection of fractures extending across field boundaries. Fracture traces of value to mining hazards analysis were noted on the EREP imagery which could not be detected on either the ERTS or high altitude aircraft color infrared photography. Stream segments controlled by fractures or joint systems could be identified in more detail than with ERTS imagery of comparable scale. ERTS mine hazards products will be modified to demonstrate the value of these additional data in the Indiana Test Area.

I. Mine Subsidence

Several areas of mine subsidence occurring in the Busseron Creek area near Sullivan, Indiana were successfully identified using S-190 B color photography.

Subsidence phenomena themselves could not be detected on ERTS imagery of the same area, although information related to subsidence prediction is available using ERTS.

B. Mined Land Inventory and Reclamation Analysis

I. Surface Coal Mining Operations

EREP photography affords an increase over comparable scale ERTS imagery in the level of information which can be obtained in mined lands inventory and reclamation analysis. Variations in the percentages of vegetative cover may be accurately^{2/} defined through systematic analysis of EREP photography. SKYLAB provides an accurate and complementary information base from which changes in (for example) percentage of vegetative cover in mined areas can be monitored through successive ERTS overflights.

2. Non-Fuel Mining

A review of EREP color photography (1:1,000,000 scale) permitted the identification of a substantial number of non-fuel (limestone, sand and gravel, clay, etc.) mines within the Southern Indiana Test Area. Comparison with historical (1970 and 1971) small scale aerial photography revealed changes in mined area and other evidence of active (or recently active) mining sites.

2/

This must yet be more firmly established. Enlargements of the 1:1,000,000 color photography were not available at the time of this report.

A new mine was detected on the EREP photography without prior data (ground truth). EREP (or comparable resolution/scale photography) has definite value for estimating areal changes in active mines and for detecting new non-fuel mines.

The resolution of EREP photograph permits the identification of (for example) gravel pits which are normally too small in areal extent to be identified with comparable scale ERTS imagery. If funding permits, an Inventory Map of Non-Fuel Mined Lands (SKYLAB Series) may be developed for a selected test site within the Southern Indiana Test Area.

C. Mining and The Environment

1. Mine Refuse (Gob) Pile Inventory

Gob piles and slurry ponds of several acres could be detected on the S-190 B color photography when observed in association with large scale mining operations. Identification or discrimination between these two types of mine waste proved difficult using this photography as the sole data source. An important application of gob pile data for the State Legislature may be defined with further study.

2. Water Quality

Apparent degradation of water quality resulting from acid mine drainage and/or siltation was noted in several ponds or

small lakes and appear to be related to intensive mining activity near Sullivan, Indiana. Additional field checking will be necessary to determine the source of this (apparent) impact.

D. NASA Program Planning

Data related to NASA's ERTS program and particularly the resolution requirements for future ERTS - type vehicles will result from these studies and strengthen the argument for a continuing high altitude aircraft program.

SUMMARY OUTLOOK:

Based on a comparison of EREP with ERTS-1 and high altitude aircraft imagery of Indiana, high resolution-synoptic SKYLAB data is an important complement to ERTS-1 and high altitude imagery. Funding limitations will be the only reason why a significant number of user-oriented SKYLAB products derived from this program will be limited.

TRAVEL SUMMARY AND PLANS:

A field trip was conducted in the Indiana Test Area from August 13-16, 1973 to gather various types of ground truth data (see OVERALL STATUS) for the ERTS-1 and EREP investigations. No travel plans have been made for the next quarterly reporting period.